PB82-208703

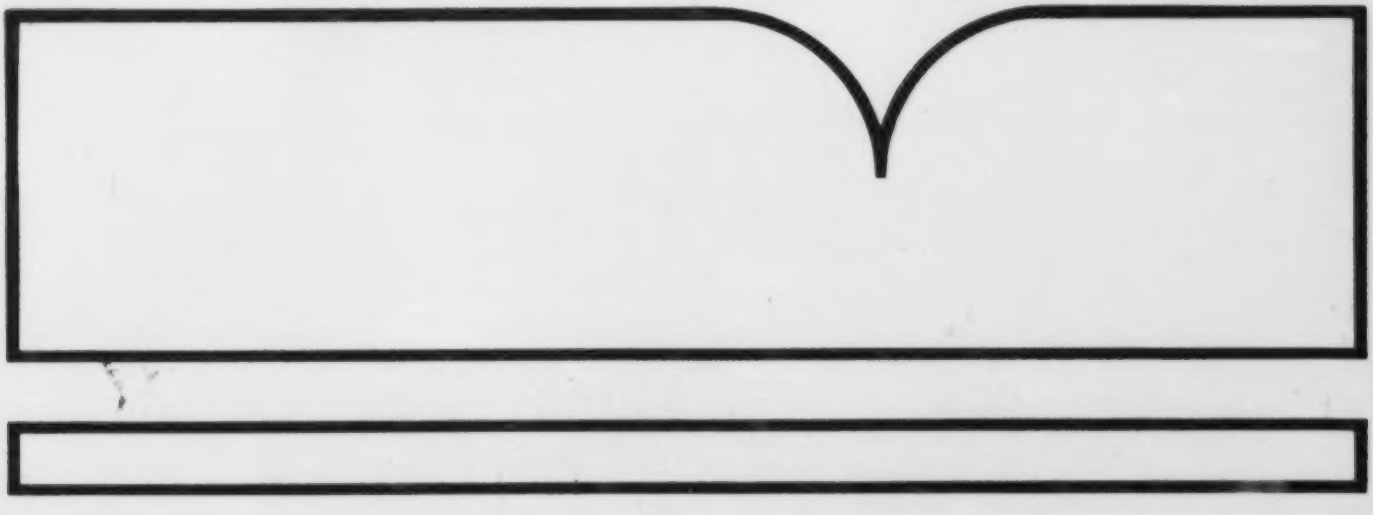
Survey of Potential Markets for Energy Recovery from Solid Waste in the Metropolitan Area of Atlanta, Georgia

CSI Resource Systems, Inc.
Boston, MA

Prepared for

Environmental Protection Agency
Atlanta, GA

Oct 81



U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO.	2.	3. Recipient's Accession No. PB82-208703

4. Title and Subtitle
Survey of Potential Markets for Energy Recovery from Solid Waste in the Metropolitan Area of Atlanta, Georgia

5. Report Date
October 1981

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
CSI Resource Systems, Inc.
Boston, Massachusetts

10. Project/Task/Work Unit No.
Work Assignment 30

11. Contract(C) or Grant(G) No.
(C) 68-01-6004
(G)

12. Sponsoring Organization Name and Address
Office of Solid Waste Management
U.S. Environmental Protection Agency
Region IV, Atlanta, Georgia

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

This report represents the results of potential resource recovery markets for the region. It was prepared for the Atlanta, Georgia, Regional Planning Commission, and four of its constituent governments: the City of Atlanta along with the Counties of Fulton, Cobb, and DeKalb. The survey was supplemented with a review of energy recovery technologies and the identification of major tasks to be performed before the four county region can decide whether to implement a resource recovery project. These activities reflect the results of several site visits, personal interviews with several industrial, institutional, utility and governmental energy users, including municipal officials and a telephone survey of 120 energy consumers.

17. Document Analysis a. Descriptors
Solid Waste; Resource Recovery

b. Identifiers/Open-Ended Terms
~~City of~~ Atlanta (Georgia)
Counties of Fulton, Cobb and DeKalb (Georgia)
~~ARC (Atlanta, Georgia, Regional Planning Commission~~)

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Release to Public	Unclassified	52
	20. Security Class (This Page) Unclassified	22. Price 0

(See ANSI-Z39.18) *See Instructions on Reverse*

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

PB82-208703

United States
Environmental Protection
Agency

Region 4
345 Courtland Street, NE
Atlanta, GA 30365

OCTOBER 1981

Solid Waste

EPA

A TECHNICAL ASSISTANCE PROGRAM REPORT

Survey of Potential Markets for Energy Recovery from Solid Waste in the Metropolitan Area of Atlanta, Georgia

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

Public Law 94-580 - Oct. 21, 1976

Technical assistance by personnel teams. 42 USC 6913

RESOURCE RECOVERY AND CONSERVATION PANELS

SEC. 2003. The Administrator shall provide teams of personnel, including Federal, State, and local employees or contractors (hereinafter referred to as "Resource Conservation and Recovery Panels") to provide States and local governments upon request with technical assistance on solid waste management, resource recovery, and resource conservation. Such teams shall include technical, marketing, financial, and institutional specialists, and the services of such teams shall be provided without charge to States or local governments.

This report has been reviewed by the Project Officer, EPA, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Project Officer: Elmer G. Cleveland

SURVEY OF POTENTIAL MARKETS FOR ENERGY RECOVERY FROM SOLID WASTE IN THE METROPOLITAN AREA OF ATLANTA, GEORGIA

PREPARED FOR
OFFICE OF SOLID WASTE MANAGEMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV

BY
CSI RESOURCE SYSTEMS, INC.

October 1981

PREFACE

This report was prepared for the Atlanta Regional Commission and four of its constituent governments (City of Atlanta and Fulton, Cobb and DeKalb Counties) in Georgia, under the Technical Assistance and Panels Program, which is conducted by the U.S. Environmental Protection Agency (EPA) to provide assistance to state and local governments. Technical assistance was provided in response to requests submitted to U.S. EPA Region IV by the Atlanta Regional Commission and the four governments named above.

The report presents the results of a preliminary survey of potential resource recovery markets for the region. The survey was supplemented with a review of energy recovery technologies and the identification of the major tasks to be performed before the four county region can decide whether to implement a resource recovery project. These activities reflect the results of several site visits to the region by CSI Resource Systems, Inc., personal interviews with several industrial, institutional, utility and governmental energy users and municipal officials, and a telephone survey covering over 120 energy users.

Resource Systems is a technical assistance contractor to the Office of Solid and Hazardous Waste, U.S. EPA Region IV. Under the terms of the Technical Assistance and Panels Program, all of Resource Systems' technical assistance activities on behalf of the Atlanta Region were paid for by EPA.

Resource Systems wishes to thank especially the following individuals for their support and generous cooperation: Cedric Maddox, Director of the Bureau of Sanitary Services in Atlanta; Howard Frandsen, Assistant Director and Chief Engineer, Fulton County Public Works Department; Edward King and Charles Brown, Georgia Power Company, District Heating Division; Stephen Peet, Atlanta Airline Terminal Corporation; Barry Filby, Delta Airlines; Jack Ramsey and Glenn Jardine, Lockheed Georgia Corporation; Moses McCall and Claude Goodly, Georgia Environmental Protection Divsion; and Paul Kelman, Atlanta Regional Commission.

TABLE OF CONTENTS

PAGE

PREFACE

CHAPTER 1. OVERVIEW..... 1
FINDINGS AND CONCLUSIONS..... 3
NEXT STEPS..... 5

CHAPTER 2. SURVEY OF POTENTIAL ENERGY MARKETS AND APPLICABLE TECHNOLOGY..... 6

A. POTENTIAL MARKETS..... 8
DOWNTOWN ATLANTA DISTRICT STEAM LOOP..... 8
ATLANTA INTERNATIONAL AIRPORT..... 14
R.M. CLAYTON SEWAGE TREATMENT PLANT..... 17
LOCKHEED-GEORGIA CORPORATION..... 18

B. APPLICABLE TECHNOLOGIES..... 21
MASS BURNING SYSTEMS..... 21
COMBINED RDF-PRODUCTION/DEDICATED BOILERS..... 22

CHAPTER 3. STEPS TOWARD IMPLEMENTATION..... 23
IMMEDIATE NEXT STEPS..... 23
IMPLEMENTATION STEPS..... 26

APPENDIXES

METHODOLOGY..... A
ENERGY USERS WITH LIMITED MARKET POTENTIAL..... B
ATLANTA-AREA ENERGY USERS INERVIEWED WITH LIMITED MARKET POTENTIAL..... C
ENERGY USERS WITH NO MARKET POTENTIAL..... D

CHAPTER 1. OVERVIEW

The Atlanta Regional Commission (ARC) is the Area Planning and Development Commission for the seven-county area surrounding the City of Atlanta, Georgia. ARC has been designated the agency responsible for solid waste planning in the region, which has a population of 1.8 million. In 1980 the ARC, working under a grant from the Georgia Environmental Protection Division (EDP), produced a staff working paper titled "Survey of Solid Waste Systems in the Atlanta Region." To continue its solid waste planning program, ARC and four of its constituent governments (the City of Atlanta, and Fulton, Cobb, and DeKalb Counties) requested technical assistance from the U.S. Environmental Protection Agency (EPA) to identify energy markets in the region that could be considered candidates for solid waste resource recovery projects. This study is the result of that request.

This study has two overall objectives: first, to survey major energy users in the Atlanta region and to select those judged to have the greatest potential as markets for waste-to-energy projects; and second, to delineate the next steps necessary to confirm the feasibility of potential energy markets and implement one or more resource recovery projects.

The feasibility of resource recovery depends on five general requirements:

1. Potential customers whose energy requirements could be supplied by usable, or processible solid waste generated.[1]

2. A sufficient tonnage of processible solid waste from which enough energy and/or salable materials could be produced to meet the requirements of one or more potential energy users.

3. Potentially viable project sites located near sources of solid waste and buyers of recovered energy.

---

1. Processible solid waste is the percentage of total available waste that could be processed in a resource recovery facility. Unprocessible materials include oversized, bulky waste (e.g., large metal objects, bed springs, rugs) and white goods (e.g., refrigerators).

4. Commercially available technologies that can reliably process available solid waste and produce energy and/or salable materials in the form, quality, and quantity required by prospective buyers.

5. A total disposal cost that is competitive with available alternative disposal methods.

This study focuses on the important first step of determining whether resource recovery from all or a substantial portion of the waste generated in the four-jurisdiction area may be feasible by inventorying the energy consumptoin of the large firms and institutions in the region and interviewing the most likely users of recovered energy. The first step in the methodology was a survey of several data sources to inventory the type and quantity of energy used by companies in the region. Next, a telephone survey of over 120 likely candidates was conducted. Finally, 12 potential energy users were screened in a series of personal visits. Only four potential candidates were identified with sufficient energy requirements to support resource recovery projects to warrant further analysis as the result of this screening process.[2] In addition, several commercial waste-to-energy technologies were defined as technically feasible for the potential markets. Finally, the procedures necessary to conduct a full-scale project study were reviewed and guidelines for pre-implementation steps discussed.

The remainder of this chapter is an overview of the study findings and conclusions and a summary of the next steps for confirming project feasibility and beginning implementation. Chapter 2 describes the potential markets in detail and surveys appropriate technologies. Chapter 3 includes the next steps necessary to evaluate project feasibility and manage implementation. Appendix A is an explanation of the market survey methodology; market candidates for further study are identified in Appendix B; and potential energy users that did not meet the screening criteria are tabulated in Appendixes C and D.

---

2. The Snapfinger Advanced Wastewater Treatment Plant being constructed in DeKalb County is potentially a fifth market in the region. This project was the subject of a separate EPA Technical Assistance report published in March 1980.

FINDINGS AND CONCLUSIONS

About 5,500 TPD_7 (tons-per-day on a 7-day-per-week basis) of solid waste are generated in the seven-county greater Atlanta region, according to the ARC "Survey of Solid Waste Systems in the Atlanta Region." About 3,400 TPD_7 of this total are generated by the four jurisdictions sponsoring this request for technical assistance. These wastes are currently hauled to 22 regional private and public landfills. In some areas, wastes are first processed or baled to reduce volume before landfilling.

A number of the landfill sites in the jurisdictions covered in this study have sufficient capacity to accommodate waste disposals for the next 10 years or more; others must find new landfill sites or develop alternative disposal arrangements immediately. Although not documented specifically in the ARC study, it is reasonable to estimate that new landfill sites or alternative disposal methods will be required for projected waste quantitites of about 1,000- to 1,500-TPD_7 in the next 3 to 5 years (the time required for full implementation of one or more resource recovery projects).

The four markets for waste-derived energy identified in this preliminary market study are only potentially qualified candidates, given the energy requirements of the markets, and the economic and institutional uncertainties associated with each. Even under the most optimistic scenario for full implementation of all four energy recovery projects, these projects would account for less than one-half of the waste stream generated in the four jurisdictions sponsoring this study and less than a third of the Greater Atlanta area waste stream. It is even questionable whether these projects would initially require the energy output available from the 1,000- to 1,500-TPD_7 wastes soon to require disposal capacity, although they may utilize energy recovered from even more tonnage sometime in the future. Without firm commitments from an entity empowered to implement resource recovery projects, there is little chance that a facility will be built in the four-jurisdiction area, despite the presence of positive market factors.

The four potential candidates for waste-to-energy projects are:

- The Downtown Atlanta District Steam Loop of Georgia Power: Potential market for a system capacity ranging from 200- to 600-TPD_7 or higher. Many implementation issues must be resolved, including the ability to increase steam demand, project sponsorship, competitive pricing of steam, loop, siting, waste acquisition, and project financing.

- R.M. Clayton Sewage Treatment Plant: Potential for processing about 300 TPD_7. Project implementation will be evaluated further in an upcoming City of Atlanta-sponsored feasibility study focusing on sludge disposal options.

- Atlanta International Airport: Potential for two types of systems--a 100-150 TPD_7 system using airport wastes, or a 250-300 TPD_7 system that could import wastes from public and private sources to supplement those generated at the airport. The larger the system the more difficult it would be to implement because of such issues as siting, traffic access, waste acquisition, the substantial capital expenditures required for a long steam line and for electrical generating equipment to utilize excess steam.

- Lockheed-Georgia Corporation: Potential for a system in the 300-TPD_5 capacity range. The project's feasibility depends on successfully demonstrating to Lockheed management that waste-to-energy technology is reliable and that waste delivery can be arranged that would not interfere with employee traffic. Because the plant facility is owned by the U.S. Department of Defense (DOD), such issues as recovery site ownership and location, changes to existing plant, and energy purchase guarantees would have to be negotiated with DOD.

The economic feasibility of any or all of the potential markets projects cannot be resolved at this time. Present disposal costs for major public and private landfill operators are relatively low. It is doubtful that an energy recovery system could compete economically with landfill disposal, at least in the short term. However, as the capacities of regional landfills are reached, and more stringent state landfill standards take effect, well-structured resource recovery systems should be cost-competitive with other future disposal options, such as hauling to remote landfills. Implementation of an energy recovery project reduces the volume of municipal solid wastes that must be landfilled to 10 percent or less.

As a result, the remaining useful life of existing landfills can be greatly extended, and the need to site new landfills significantly reduced. Because of a fairly lengthy period of time between the start of feasibility studies and the actual operation of an energy recovery facility, the feasibility of undertaking one or more energy recovery projects in the four-county area should be determined in the very near future.

NEXT STEPS

To proceed with any of the resource recovery opportunities identified in this study, the ARC, the City of Atlanta, or any of the Atlanta region counties must complete a number of steps to ensure institutional, technical, and economic feasibility. In summary, these steps include the following:

- Evaluate the willingness of the candidate buyers to cooperate in an in-depth feasibility study
- Conduct the study in phases; project feasibility should be confirmed at the end of each phase before beginning the next one
- Appoint a full-time manager with the authority and responsibility to direct the feasibility study
- Develop a scope of work and contract with a consulting firm to confirm project feasibility
- If and when feasibility is confirmed, designate an organization legally empowered to carry out a project and organize a team consisting of financial, legal, and engineering/management consultants to develop the project--including waste acquistion, negotiations with energy buyers, system procurement, and development of a financing plan
- Implement procurement plan drawing on public and private resources.

CHAPTER 2. SURVEY OF POTENTIAL ENERGY MARKETS AND APPLICABLE TECHNOLOGIES

The economic viability of resource recovery depends, to a great extent, on the revenues from the sale of the energy products. Other economic factors include site and system requirements. The price that can be obtained for waste-derived energy, in turn, depends on the price of the fuel it displaces. These energy products include steam; high-temperature, low-Btu gas; electricity; and refuse-derived fuel (RDF).

Steam production seems to offer the greatest potential in the Atlanta area. Generating electricity from waste would be less cost-effective than the recovery of other energy products because most electricity generated in Georgia is produced by coal, which is relatively less expensive than other fossil fuels. RDF can be produced for sale to customers who could cofire RDF with coal in existing boilers, either on- or off-site, to produce thermal energy. Only in a few special situations would cofiring RDF be economically viable because of the low value of displaced coal. In addition, there are significant technical issues associated with burning RDF as a supplemental fuel in existing boilers. There are no customers for recovered gas in the Atlanta region that met the market study screening criteria.

Siting is a major factor in determining the technical and economic viability of resource recovery projects. For steam customers, resource recovery sites can be located within a 1- to 2-mile radius. In additon, steam customers should be located close to the centroid of the wasteshed being served. Site location is less of an issue for RDF customers; such customers must, however, be within an economic hauling distance of the resource recovery facility. For electricity customers, proximity to the customer is not an issue, as tie-in to the electrical grid is technically feasible at nearly any point.

However, interconnection costs may vary significantly among possible tie-ins, which in turn could influence recovery site location.

As part of this preliminary market study, 120 energy users in the Atlanta area were identified and screened, using the methodology outlined in Appendix A. Energy users with the following characteristics were selected for further study of their potential as markets for waste-to-energy products:

- Operates 24 hours per day, 7 days per week, 365 days per year
- Uses oil and natural gas as primary fuel
- Is interested in exploring the purchase of recovered energy on a long-term basis
- Has daily and seasonal energy demand high enought to use all the output from a waste-to-energy facility (i.e., the energy recovery facility can be treated as a base-loaded plant)
- Is a long-term market (i.e, the customer expects to be in business at the same site for at least the term of the financing arrangement).

The results of the preliminary survey indicate that very few Atlanta area energy users meet these criteria. Four potential markets for recovered energy, however, certainly warrant further study. These are:

- Downtown Atlanta District Steam Loop of Georgia Power
- Atlanta International Airport
- R.M. Clayton Sewage Treatment Plant
- Lockheed-Georgia Corporation.

Discussions of these four potential buyers are presented in the first section of this chapter; appropriate commercially tested technologies for supplying recovered energy to the markets are surveyed in the second section. Several other energy buyers, including some of

those interviewed, failed to meet one or more criteria. As a result, they cannot be considered as potential buyers for recovered energy, although they may warrant further study. (See Appendix B.) Appendixes C and D are tabulations of other energy users interviewed having little to no resource recovery potential.

A. POTENTIAL MARKETS

Each potential buyer for recovered energy is described in this section in the context of energy uses, potential for resource recovery, and potential constraints on project development.

DOWNTOWN ATLANTA DISTRICT STEAM LOOP OF GEORGIA POWER

The Georgia Power Company (GP) has operated a district heating/cooling steam loop system in the City of Atlanta for several decades. Steam supplied to a 15-mile underground network provides heating, hot water, and cooling to many buildings in the downtown area. At first, steam was raised with coal-fired boilers and for several years that steam was supplemented with steam generated at the City of Atlanta's heat recovery incinerator. Both the coal plant and the incinerator were closed in the early 1970s because of noncompliance with air pollution regulations.

Energy Uses

Since 1973 GP has generated steam in a plant burning natural gas (with distillate oil backup) located on Martin Luther King Avenue at the south-eastern side of the loop. The plant has four boilers that can generate 200,000 pounds of steam per hour (lb/hr) for a total peaking capacity of 800,000 lb/hr. In 1980, the system sold 433 million pounds of steam to 73 customers. However, it generated another 112 million pounds to overcome losses in the distribution system, for a total delivery to steam mains of about 545 million pounds. Peak, average, and minimum loads were 210,000, 62,000 and 30,000 lb/hr respectively. None of the condensate (exhaust steam) is returned by the customer to the plant.

Demand for steam from th system has declined each year since the early 1970s. For example, 749 million pounds were sold to 197 customers in 1976, about 73 percent more than 1980 sales. There are several reasons for this decline, many of which are typical of urban district heating loops across the country:

- Urban renewal projects in the early 1970s resulted in the demolition of many of the older buildings that brought steam from the loop.

- Electrical rates in the state are relatively low, as GP relies on coal as its primary fuel. Because steam is not cost-competitive, many customers select electrically driven air-conditioning equipment instead of steam absorbtion chillers.

- The conversion of coal to gas in 1973 puts the loop on the same fuel base as most of its potential customers. Any potential savings that a customer connected to the loop might realize by not owning or operating a heating system is at least partially offset by two factors:

  - GP's distribution losses, which are passed on to loop customers, are currently 25 percent of steam delivered.[1]

  - In-building heating systems can easily recover and reuse most of their condensate, resulting in a savings of approximately 10 percent of the energy content and the costs of purchasing and treating new water.

Thus, with a present price of steam delivered to a customer at between $10 and $11 per thousand pounds, GP finds it difficult to compete for new customers. The net result of this business decline is that GP is utilizing only a small fraction of its generation and distribution investment and cannot fully service its debt.

---

1. Distribution losses are virtually fixed so that they become a smaller percentage of sales as sales increase, and vice versa.

Outlook for Increased Steam Sales

Despite the difficult business situation GP faces, there may be some approaches to restoring a viable base for steam sales. There are sufficient markets located near the loop that, if connected, would allow the system to operate at capacity. Successful competition for those markets requires at least four conditions:

- An alternative fuel or steam source that is less expensive than natural gas
- Fuel deregulation of natural gas (assuming that it will be priced enough about the alternative fuel to offset line losses and condensate losses)
- Government pressures on public buildings to connect to the loop
- Aggressive pricing policy by GP would both pass along operating savings to customers (including the decreased percentage of line losses as steam sales rise) and reduce charges for fixed costs that tend to make steam economically noncompetitive.

Resource Recovery Potential

GP should be aware of the opportunities for resource recovery that might both increase the viability of the loop and reduce the Atlanta area's waste disposal problems. Energy recovered from the solid waste generated by Atlanta and surrounding areas could displace some of the natural gas burned by GP. Steam could be delivered from a resource recovery plant located within a few thousand feet of the loop. Potential plant sites may be available near the southern part of the loop. Refuse-derived steam could be used as a base load throughout the year while GP's existing gas-fired plant would provide peaking, load following, and back-up capacity. The waste-to-energy facility could be sized to accommodate a throughput somewhat larger than the loop's baseload requirements. Excess steam could be diverted to a turbine/generator for the production of electricity if the necessary equipment costs can be economically justified. If baseload demand increases, the resource recovery plant could be enlarged by adding modular increments

of capacity. Once gas dereg. lation is complete, refuse-derived steam could be priced to make the loop's price competitive with in-building systems fired by natural gas.

The amount of waste that could be processed in the steam loop depends on GP's success in attracting new steam customers. The following table estimates waste throughput under three arbitrarily selected scenarios: 1980 sales; 1980 sales plus sales to two public customers, Grady Hospital and the Federal Reserve Building; and 1980 sales, sales to two public buildings, plus sales to a number of new privately owned buildings. The estimate of solid waste consumed in each scenario is based on the assumption that about 80 percent of the steam produced would be sold to the loop and the remaining 20 percent would be diverted to produce electricity.

PROJECTED RESOURCE RECOVERY SYSTEM
DAILY THROUGHPUT RESULTING FROM
INCREASED STEAM DELIVERIES TO LOOP

SCENARIO	MILLION POUNDS OF STEAM TO LOOP PER YEAR	ESTIMATED WASTE THROUGHPUT
1. Existing Sales (1980)	545	213
2. Addition of 2 Public Buildings	368	144
3. Addition of Several Private Buildings	640	250
Total: Scenarios 1 and 2	913	357
Total: Scenarios 1, 2, and 3	1,553	607

The waste throughputs identified in the table illustrate possible system size requirements. However, a system that could handle 600-TPD[7] throughput is a reasonable target; that figure represents most of the City of

Atlanta-collected waste stream (1,100 TPD_5 or 785 TPD_7) and it would mean steam loop sales are at a level to require winter peaking capacity close to the GP steam plant capacity.

Constraints to Implementation

While a 600-TPD_7 system for the steam loop may be technically and economically viable in the long run, several implementation issues may be difficult to resolve. Some of these issues are discussed in the paragraphs below. A more general discussion of resource recovery implementation issues is given in Chapter 3.

Early Year Economics. Officials of both the City of Atlanta and Fulton County estimate that disposal costs are in the range of $4 per ton. It may be impossible for a refuse-to-energy plant to match that disposal cost, especially in the early years of plant implementation. The City may not wish to send its waste to a recovery system until it is the least expensive alternative.

Small Systems. The 1980 steam demand represents an appropriate market for a reasonably sized waste-to-energy plant. However, the loop cannot survive in its present form at this level of demand. Obviously, GP must increase the number of customers before making a firm steam purchase agreement. Moreover, if the system were to recover energy from a smaller amount of waste (e.g., at the 200- to 300-TPD_7 level) and then require 500 TPD_7 or more as demand increases, the appropriate technology would change from factory-assembled units to more capital-intensive field-erected units. (See the review of appropriate technologies later in this chapter.) Probably, the larger field-erected system should be built to accommodate future demand, even for the small 200-300 TPD_7 loads envisioned during the first few years of the project. As a result, disposal costs will be high during the early years of the system.

Market Growth. The steam loop offers the greatest market potential at the 500-600 TPD_7 range. As the current market is much smaller, it is unlikely that a system of that size will be built until the market increases. In turn, GP will not be able to attract new customers until

its fuel prices are cheaper than other fuel sources. Resolving the dilemmas inherent in attracting new loop customers and selecting system size will require significant trust and sharing of risk between GP and the project sponsor.

Project Sponsorship. It may be difficult to identify a sponsor for this project because of the poor history of interlocal cooperation on solid waste issues. The most logical sponsor is the City of Atlanta; however, it does not have an imminent disposal crisis. At the same time, the City may be reluctant to have another governmental entity (e.g., Fulton County, which must find new disposal sites immediately) or a private firm sponsor such a project within the City. The City could create a special authority sponsored by the City and one or more counties, but even this compromise will require a high degree of cooperation.

Summary

The success of a resource recovery system in selling steam to the loop depends on the following steps:

- Establish project sponsor
- Secure agreement from waste generators to guarantee minimum levels of waste
- Secure the following commitments from GP and the project sponsor:
  - GP agrees to purchase steam
  - GP agrees to a steam sales policy which is competitive with fossil fuels
  - GP agrees to an electricity purchase rate which can reasonably support the project during low steam demand
  - GP provides generation capacity for peaking, back-up and load following
  - GP assumes appropriate share of risks

- Sponsor provides base load steam
- Sponsor secures the connection of public buildings to loop
- Sponsor considers an ordinance that will give incentives to private buildings converting to loop steam
- Sponsor agrees to a steam price competitive with or cheaper than the cost of raising steam with gas
- Sponsor removes the 4-percent franchise tax on steam sales
- Sponsor assumes reasonable share of project risks.

ATLANTA INTERNATIONAL AIRPORT

The Atlanta International Airport is located 9 miles south of the center of Atlanta. The new passenger terminal complex, opened in October 1980, is the largest in the world. It is owned by the City of Atlanta, but operated and maintained by the Atlanta Airline Terminal Corporation, a joint venture firm of several airlines. Of the several other energy users on the airport property, only the Delta Airlines Jet Base uses significant amounts of energy. The jet base is the major maintenance facility for the entire Delta fleet of jet aircraft. It is located about 3,000 feet from the last terminal concourse.

Energy Uses

The major energy demands for both the terminal and the jet base are for steam raised to 235 psig (pounds per square-inch guage) at 560°F. Both facilities use natural gas; both can use oil as a backup in case natural gas supplies are interrupted.

The terminal's powerhouse, located near the International Concourse, has three boilers. The steam is used to produce hot and/or chilled water, depending on the season, to heat or cool the facility. Steam flows range from about 10,000 to over 50,000 lb/hr with the peaks occurring on hot summer days.

The jet base powerhouse is located near the terminal powerhouse and also generates steam primarily for cooling and heating. Steam flows vary between 15,000 to over 50,000 lb/hr, with the peaks occurring in the winter heating season, and to a lesser extent, during hot summer days. Night requirements, when maintenance crews use steam for process needs, are typically 30 percent below daytime steam requirements.

Resource Recovery Potential

According to representatives of both the terminal and the jet base, it is probably feasible to tie the two energy delivery systems together to provide one steam market baseloaded with steam produced by solid waste. One or more existing boilers could be used to (1) provide supplemental steam needed in excess of the waste-to-energy plant capability, and (2) "load follow" (i.e., accommodate the minute-by-minute demand fluctuations from the combined load). All existing boilers could be kept on standby to provide backup for scheduled or forced outages of a waste-to-energy facility.

Terminal and jet base personnel will soon perform separate and joint feasibility studies of the use of airport wastes as a source of energy. Federal regulations mandate that wastes from international flights (approximately 20-30 TPD_7) must be incinerated or otherwise rendered innocuous. Although there are no current accurate estimates of total waste generation at the airport, it was felt that close to 100 TPD_7 might be made available for recovery.

A very rough estimate of the size of the wastestream that would be appropriate for this energy market is based on reasonable estimates of the hourly and daily fluctuations and the assumption that a smaller portion of the demand would be supplied by the existing load-following boiler. The following table shows the approximate percentage of available steam sold for selected levels of waste throughput.

Daily Throughput (TPD_7)	Approximate Percentage of Steam Sold
100	95-99
150	90-95
200	79-84
250	70-75
300	60-65

As a resource recovery plant operator must maximize energy revenues, it probably would be necessary to use the unsold steam to generate electricity. Therefore, a turbine-generator set and other electrical appurtenances must be included in the facility. As electrical revenues per ton of steam consumed will not match steam revenues, the upper economic size range of a facility located at the airport would probably not be much beyond 300 TPD_7. The lower throughput limit would probably be close to 100 TPD_7, the approximate level of wastes available at the airport. This limit is near the low end of the size range at which a refuse-to-energy plant can compete economically with other solid waste disposal alternatives such as landfill. The size of the system must also be determined by site considerations and truck access.

Site Availability

A smaller, 100-TPD_7 internal system (using only wastes available from airport activities) requires only modest receiving facilities. Several feasible airport sites are available for the construction of internal systems.

A larger external system (up to 300 TPD_7), in which most of the wastes would be brought in from outside, requires more land-intensive receiving facilities. A site must be chosen near the eastern perimeter of the airport to prevent interference of waste deliveries with airport traffic. Although there are a few potential

sites in the eastern area tha might support a larger, external system, steam generated at these sites must be piped several thousand feet to the jet base, which would increase the cost of the project.

Summary

Although there are many facts to be checked during the feasibility studies, both a 250-300 TPD_7 external system and a 100-150 TPD_7 internal system appear to be potentially feasible. An internal system would be easier to implement for several reasons:

- The economics would be more attractive because the project would require a shorter steam line, no electrical generation equipment, and more modest receiving facilities, and would yield higher per-ton revenues.
- Airport waste generators could afford higher tip fees because part of both the collection and disposal costs would be credited to the operation.
- An internal system would pose fewer and less complex issues relating to waste recovery, public sponsorship, or financing than an external system.

The most obvious disadvantage of a smaller internal waste system at the airport is that it does not address the waste disposal problems of the four-county area.

R.M. CLAYTON SEWAGE TREATMENT PLANT

Located along the Chattahoochee River near Route 280, Atlanta's public works complex contains a sewage treatment plant, a water treatment plant, a pumping station, and a refuse shredder, baler, and transfer station located in a converted incinerator. The water and wastewater facilities consume large quantities of electricity (purchased from GP) and steam produced with coal, oil, and natural gas.

Because of difficulties in disposing of sludge at the Clayton plant, City officials are authorizing a feasibility study to evaluate methods of resolving these problems. One method to be considered is the use of the energy in the City's solid wastes to dry and help burn the sludge; in turn, the energy produced would reduce the Clayton plant's reliance on fossil fuels and purchased electricity. The City plans to hire a consultant to begin work on this study within a few months. This City study of the Clayton plant will quickly supercede the present EPA survey; as a result, a site visit was not attempted. However, the following information indicates that resource recovery at the Clayton plant and surrounding facilities may be economically feasible.

Resource Recovery Potential

The combined 1980 energy budget for the water and waste facilities at the Clayton plant was about $3.4 million. Most of this budget was earmarked for electricity and steam coal, while some funds were spent on premium fuels such as natural gas and oil. Assuming these uses are reasonably constant, the Clayton energy demand would suggest a resource recovery plant throughput of over 400 TPD_7. That size range could consume a substantial portion of Atlanta-area wastes, but the economics may be difficult to justify because of the preponderance of nonpremium fuels that would be replaced. The city study of the Clayton plant should clarify the resource recovery potential at this site.

LOCKHEED-GEORGIA CORPORATION

Lockheed is one of Greater Atlanta's largest employers; it currently employs about 13,800 people at its plant on South Cobb Drive, just south of Marietta, Cobb County. The company manufacturers aircraft primarily for the U.S. Department of Defense (DOD) in a facility owned by DOD. At present, Lockheed employees work two shifts, 5 days per week, but this chedule is subject to change.

Energy Uses

Lockheed uses saturated steam primarily at 125 psig for process requirements and space heating. The steam is raised in four 100,000 lb/hr boilers, using natural gas as a primary fuel and oil as a backup. Steam loads vary greatly with the shifts, weekends, and seasons. Winter peaks during work shifts are at about 200,000 lb/hr, and summer low levels are close to 28,000 lb/hr during off-shifts.

Steam currently costs between $5 and $6 per thousand pounds, which includes fuel, operating and maintenance costs, and allocated overhead. Steam costs are expected to increase sharply with the eventual fuel deregulation of natural gas. Lockheed-Georgia is in the process of reducing steam costs by installing a modular solid waste combustion unit with a waste heat boiler. This unit will consume in-plant wastes.

Resource Recovery Potential

The steam use pattern at Lockheed indicates that about 85 percent of the energy produced by a 300-TPD_5 waste-to-energy facility would be consumed over the year. A larger steam facility would only be able to sell all of its steam intermittently. Even with a 300-TPD_5 plant there would be excess capacity during the off-shift during all but the winter season. This surplus could be dealt with by diverting steam through a turbine-generator to make electricity, wasting some of the energy, or reducing operating levels.

Summary

Such a waste-to-energy system would probably be technically feasible and economically attractive. However, a number of institutional issues must be resolved:

System reliability. Lockheed engineering personnel will not make project commitments until they are convinced that available technologies can produce the quantity and quality of steam the company requires over extended operating periods. It is likely that visits by company engineers to one or more energy recovery facilities would demonstrate that waste-to-energy systems can meet acceptable levels of reliability.

DOD involvement. Because DOD owns the plant and most of the surrounding land, DOD officials must be involved in siting a waste-to-energy facility and approvals of the minor modifications in the plant necessary to accommodate steam and condensate return piping.

Access. The road leading to the Lockheed plant is very congested during shift changes. One way to overcome road access problems is to schedule waste deliveries only during nonrush hours.

Cyclical demand. A long-term market commitment by Lockheed to the project was not discussed during the site visit because of the uncertainties surrounding even a short-term steam purchase. In addition, long-term commitment may be difficult to negotiate because of the cyclical nature of defense contracting and potentially fluctuating energy requirements. One possible solution would be to get a contingent market guarantee from DOD.

B. APPLICABLE TECHNOLOGIES

Briefly discussed in this section are available resource recovery technologies appropriate for the energy markets identified in the energy market survey.

Commercially demonstrated, technically viable approaches for steam production from the Atlanta area's waste include:

- Mass-burning systems employing the following technologies:
  - Modular (i.e., pre-engineered, typically preassembled) units with waste heat boilers
  - Field-erected refractory furnaces with waste heat boilers
  - Field-erected waterwall furnaces with integral boilers
- Field-erected coarse RDF production/dedicated furnaces with integral boilers.

MASS-BURNING SYSTEMS

In the case of mass-burning technology, only systems employing field-erected mass burners have actually been operated to raise superheated steam at the temperature that would be required by the two potential customers at the airport. While some modular technologies may be capable of providing 600 to 700°F steam, actual applications have not yet been commercially proven. Several adaptations of modular applications are possible: (1) supplementary use of fossil fuel to regulate flue gas temperature entering the boiler; or (2) a discrete fossil-fuel-fired superheater. Although neither modification should present any technical problems, they have never been applied in an operating modular system. Discrete superheaters are in use in industrial applications, but not extensively.

From a capital cost point of view, a system using preengineered, preassembled, mass-burning technology appears to be most promising for systems with a potential throughput under 300 TPD. That size range will be appropriate for most of the markets identified in the market study, with the possible exception of the steam loop project. The rule of thumb for

calculating the capital cost of modular systems is $35,000 to $50,000 per ton of installed capacity. Operating and maintenance costs for a system operating 24 hours per day, 7 days a week and 365 days per year are approximately similar for small-scale modular and field-erected mass-burning systems. A mass-burning field-erected system is typically more capital-intensive than a modular system at the smaller size range. The rule of thumb for calculating the capital cost of field-erected systems is $50,000 to $55,000 per ton of installed capacity.

The capital cost advantage of the modular system would likely be maintained even with the inclusion of a discrete superheater or a supplementary fossil fuel burner used to regulate boiler temperature.

COMBINED RDF-PRODUCTION/DEDICATED BOILERS

Steam can also be raised with a dedicated, field-erected boiler that is fueled by coarse RDF produced in a waste-processing facility. The capital cost of this combined system is likely in the range of the field-erected mass-firing systems.

CHAPTER 3. STEPS TOWARD IMPLEMENTATION

The results of this preliminary survey of resource recovery markets in the Atlanta Region indicate that as many as four potential projects are worthy of further study. A number of activities must be completed and issues resolved before any commitment to implement one or more of these systems is made. Specifically, before committing substantial additional resources to a project, the appropriate governmental entity (City of Atlanta or one of the surrounding counties or some combination, herinafter called "the counties") must determine the project's technical and economic feasibility; the level of interest of the potential energy market; the quantity of processible waste available, its energy content, and seasonal fluctuations in quantity and quality; and current control of the waste streams. On the basis of these evaluations, the counties will be able to make informed decisions about selecting one or more projects for final study. This preimplementation study must resolve a number of issues (e.g., sponsorship, risk allocation, procurement, financing, optimal system design, legal and institutional problems) before proceeding with actual project implementation.

In this chapter, the immediate next steps to be taken are outlined and the remaining issues are discussed.

IMMEDIATE NEXT STEPS

Before a decision is made to proceed with implementation of a resource recovery project, a comprehensive feasibility study should be conducted to evaluate every aspect of the project. Studies are often conducted in two parts: a pre-feasibility phase to evaluate only the most basic project elements, if the results of their phase are positive, a feasibility more depth. The key tasks and levels of effort for both phases are outlined below.

Prefeasibility study

1. Re-evaluate energy customer. Assess the conditions under which the customer could make a long-term commitment. The evaluation of the Steam Loop and Clayton Sewage Treatment Plant must also determine whether an energy demand will be created to take advantage of waste-derived energy.

2. Identify feasible plant site locations.

3. Identify alternative waste-to-energy systems.

4. Perform preliminary economic evaluations on selected systems for various financing arrangements.

5. Determine waste quantities available and assess waste control problems.

6. Identify potential environmental barriers.

7. Identify legal and institutional barriers.

8. Report and recommend whether or not to proceed.

This phase should be conducted quickly and on a preliminary basis. As parts of the work can be done by county or regional planning staff members, the consulting cost of a prefeasibility study can realistically be budgeted for the $25,000 to $50,000 range and realistic time frame would be 3 to 5 months. Due to the uncertainty of what may be encountered, especially in connection with an energy market, a consultant should not be asked to commit to a fixed price or time contract.

Feasibility Study

The purpose of the feasibility study is to verify that whether a proposed system meets all project requirements (see Chapter 1) and that project financing is probably available. The result of this phase will be a decision by a project sponsor to implement or abandon the project. Many of the tasks are extensions or confirmations of the work performed under the prefeasibility study. Suggested tasks are:

1. Evaluate markets

   a. Confirm energy market interest to negotiate energy supply contract. Obtain letters of intent.

   b. Evaluate materials markets.

2. Confirm waste supply

   a. Determine quantity of wastes available throughout the year with a series of weight programs

   b. Determine energy content of wastes with a sampling and testing program

   c. Determine strategies for control of waste stream and obtain letters of intent to contract for waste supply

3. Select site

   a. Perform environmental review and identify regulatory requirements.

   b. Develop strategy to secure site.

4. Identify financing alternatives. This task should involve the services of a qualified financial adviser or investment banker.

5. Establish system design definition. This task involves selection of energy product and materials to be recovered, equipment configuration, hours of operation, etc.

6. Perform economic analysis of capital costs, operating costs product revenues and net disposal costs for each year of project life.

7. Assess project risks.

8. Perform institutional analysis

   a. Establish project sponsorship-county, city, authority, private, etc.

   b. Construct administrative framework

   c. Resolve legal issues

   d. Submit project to political/public decision-making process.

9. Prepare final report integrating all tasks. Make recommendation for go-no go decision.

The most important task during this phase is project management. The appointed project manager, a staff member of the sponsoring entity, must be given the necessary authority to maintain project momentum and a firm schedule through the prefeasibility and follow-on phases.

Experience with other resour' recovery projects throughout the country indicates that half-hearted commitments generally result in failure.

Besides the management function, county staff will be able to provide major imputs for Tasks 2,3, 4 and 9. ARC staff may also be able to provide assistance for these tasks.

Depending on what is encountered, the feasibility phase can be completed in 5 to 8 months, except for the weighing program. An approximate budget of $75,000 to $125,000 for resource recovery consultants, financial advisers, and attorneys is realistic.

IMPLEMENTATION STEPS

The implementation phases of a project development can be classified as follows:

- Procurement planning
- Procurement
- Construction, shakedown and acceptance
- Operation

A useful guide for project management for both the feasibility and implementation phases of a project is the 1979 EPA publication, (available in the complete text or in a 50-page summary). The summary document describes in detail the tasks that must be completed and relates them in the form of a PERT chart.

During the procurement planning phase, a number of critical issues, many of which are interrelated, must be addressed simultaneously, rather than consecutively. The issues include:

- Who will sponsor the project?
- How should project risks be allocated?
- What procurement method should be used?
- What financing method is most appropriate?
- What are the legal and institutional barriers to implementation, and how can they be overcome?

In the following subsections each of these issues is examined, to highlight the major factors to be considered in resolving it.

Project Sponsorship

A decision must be made as to what entity should sponsor a project. Possible sponsors include: a special solid waste management authority created specifically for the project; one or more counties and/or cities in the area in a joint venture; one of the counties or cities that is interested in assuming the lead role; or a private development firm.

The creation of a special authority has certain advantages over sponsorship by an existing entity. In most states, a specially created solid waste management authority is not subject to competitive bid requirements of construction and, thus, can adopt the most appropriate procurement method, select the most qualified system vendor through negotiated bidding, and negotiate long-term contracts for solid waste delivery and system operation. The major limitation of sponsorship by a specially created enetity is its lack of taxing authority, which limits

Allocation of Project Risks

Unlike public works projects normally undertaken by local governments, resource recovery projects are risky, chiefly because

- Recovery technology is not fully proven.
- Waste volumes and composition are variable.
- Operating experience is limited.
- Product user requirements are stringent.

These factors give rise to specific risks in four areas:

1. Project economics (e.g., lifetime operating and maintenance costs, lifetime product revenues, capital costs, lifetime net disposal costs).
2. Marketing (e.g., user requirements, user investments, product prices, contract duration).
3. System performance (e.g., product quality, recovery efficiency, processing capacity, reliability, residual disposal requirements).

4. Waste stream (e.g., volume changes, composition changes, payment of disposal fees).

The sponsoring entity must evalute each area of risk and determine which participant in the project is best able to assume and manage a particular risk. For example, the project sponsor can deal with the risk that a minimum daily tonnage will fail to be delivered to the project. By contrast, the system vendor/operator can best deal with the risk that the system will not be able to process the amount of waste it was designed to handle.

In general, the system vendor can best deal with the economic and technical risks associated with the project's technology. The project sponsor will need to devise mechanisms to ensure that the system vendor assumes these risks. System vendors are often asked to provide contractual guarantees of system performance and economics (e.g., processing capacity, recovery efficiency, plant reliability and availability, product quality, O&M costs). In return, the vendor receives a service fee that compensates for the risks assumed.

Procurement Approach

There are three methods of procurement used for resource recovery projects.

- An architectural and engineering (A&E) contract is customary for facility design and equipment selection, preparation of competitive bid specification, construction supervision, and, possibly, facility shakedown. Construction and equipment installation are competitively bid. The owner takes over the facility upon physical completion. Full-scale operation and, possibly, shakedown are the responsibility of the public owner.

- A turnkey approach is where a single entity performs the services that would otherwise be provided by an A&E, plus construction, testing, and shakedown of the system. Final payment is made to the turnkey contractor following successful shakedown and acceptance by the public sponsor. Full-scale operation is the responsibility of the public owner.

- A full-service approa h is where a single contractor performs all functions of a turnkey contractor and is responsible for full-scale operation of the facility (generally ranging from 5 to 20 years).

The following list is a summary of the extent to which various project risks can be transferred from the public sector to private industry under the three procurement approaches:

Key Project Risks	A&E	Turnkey	Full Service
Project economics	None	Limited	Substantial
Marketing	None	None	Substantial
System performance	Very Limited	Limited	Substantial
Waste stream	None	None	Limited

The full-service approach vests the maximum degree of control in the vendor and, thus, offers the greatest opportunity for transferring risks to the vendor. The sponsoring entity can transfer a maximum of risk to the full-service vendor/operator by obtaining contractual guarantees for the system's technical and economic performance.

Financing Method

Resource recovery projects in the United States have typically been financed with tax-exempt General Obligation Bonds (GOBs) or Industrial Revenue Bonds (IRBs), but, as a result of recent changes in tax laws, resource recovery system vendors, developers, financing entities and industrial concerns (e.g., energy customers) are increasingly interested in assuming constructive ownership of a resource recovery facility. Constructive ownership affords substantial tax benefits (i.e, investment tax credits, depreciation tax shield). Internal Revenue Service (IRS) requirements for constructive ownership can be satisfied by making and equity contribution to the project or by assuming responsibility for its total debt service obligations.

IRB Financing. Tax-exempt IRBs are commonly used to finance resource recovery projects. Because project revenues (i.e, energy revenues and disposal fees) are the only sources of funds to retire IRBs,

a rigorous analysis of projec economics is required, to ensure that revenues will be sufficient. Hence, the effect of IRB financing is to ensure that any project implemented is fully justified on its economic merits. In addition, IRBs do not reflect on the debt capacity of the issuing entity, because the funds are borrowed on a project basis.

Equity/IRB Financing. Under this financing method, a partial equity contribution is made by a private investor (e.g., the energy customer, the system vendor, the project developer), and the balance of funding is obtained through IRBs. The equity contribution reduces the bond issue requirement and provides significant tax advantages to the private investor. Depending on the investor's tax bracket, the timing of the investment tax credit, and the depreciation period and method used, the net present value of the tax benefits resulting from a 25-percent equity contribution can represent an after-tax return. The equity contribution must be made by an entity that can utilize the tax benefits, i.e, a profitable concern with taxable income to shelter. In addition, the equity contribution vests project ownership with the private investor and, for practical purposes, requires private operation of the facility.

GOB Financing. Like IRBs, tax-exempt GOBs are commonly used to finance resource recovery projects. In addition to project revenues, the full faith and credit of the sponsoring entity are pledged to retirement of GOBs, so taxing mechanisms may be used to meet obligations in the event that project revenues are insufficient. As a result, GOBs are less risky for bond holders than are IRBs, carry a lower interest rate and bond financing costs, and are easier to market. (Bond financing costs are typically less than 0.5 percent of total bond issue for GOBs but may be as high as 3 percent for IRBs). However, because of the full faith and credit pledge, GOBs can typically be used only for projects sponsored by entities having taxation authority. In addition, GOBs do reflect on the debt capacity of the issuer. Con-

sequently, debt capacity ceilings may be reached, precluding subsequent debt issues for financing such projects as hospitals or schools.

Legal and Institutional Barriers

There are numerous legal and institutional barriers to the implementation of a resource recovery project, primarily because few projects have been implemented. Institutional and legal barriers include site acquistion problems; traffic impacts on the surrounding neighborhoods and communities; the legality of negotiated procurements, long-term put-or-pay contracts with waste haulers, and take-or-pay contracts with energy users; and the prospect of mandatory participation of private haulers. All of these barriers must be overcome before project implementation.

APPENDIX A
METHODOLOGY

The preliminary market survey of the potential for solid waste resource recovery projects in the Atlanta region is based on the following research methodology: a review of data sources, the development of screening criteria, telephone surveys, and site visits. The methodology is briefly discussed in this appendix. The four potentially viable energy markets identified during this process are described in Chapter 2; the markets eliminated through the screening process are discussed in Appendixes B, C, and D.

DATA SOURCES

Five major sources of data were used to identify candidate energy markets in the Greater Atlanta area. The sources used were:

1. The National Emission Data System (NEDS) for Georgia.
2. Atlanta Manufacturing, The Georgia Manufacturing Directory for the Atlanta Region, published by the Georgia Department of Industry and Trade.
3. Atlanta Larger Employers, published by the Atlanta Chamber of Commerce.
4. Atlanta Medical Facilities, published by the Atlanta Chamber of Commerce.
5. Standard Industrial Classification Manual, published by the U.S. Office of Management and Budget.

The first two sources, which provided the most information for this study, are discussed in more detail in Attachments 1 and 2 to this appendix.

The initial list of markets was developed by reviewing the various information sources for companies and institutions that met specific criteria relating to market potential. This initial list of potential candidates was then contacted by phone for additional information.

SCREENING DATA

The type of data available in each particular information source established the criteria for rejection. For example, since the NEDS information indicated a minimum annual fuel use in MBtu (million British thermal Units) a screening threshold of 25,000 lbs of steam per hour (lb/hr) was selected as the minimum economical waste-to-energy facility size. This threshold is approximately equivalent to a 120-TPD plant. The SIC manual was used to establish a list of those SIC numbers representing energy-intensive industries. Three criteria were used to establish this list:

1. Personal experience in the industry
2. Published data indicating energy-intensive processes
3. Presence of similar SIC-related industries on the NEDS data base for the Atlanta or Georgia area.

Once this list was established, it was used to screen the companies listed in Atlanta Manufacturing.

Atlanta Manufacturing listed several items of information on each company, including SIC (Standard Industrial Classification) number and number of employees. A SIC number in one of the categories identified as a potentially energy-intensive industry or with more than 100 employees resulted in the additon of the company's name to the list of organizations to be contacted.

Atlanta Larger Employers, which lists Atlanta region firms and institutions, was used as a reference to ensure that larger employers were included in the initial screening list. All larger employers with energy-intensive processes were previously identified in Atlanta Manufacuring. The publication was also used to identify institutions (e.g., schools, hospitals) with many employees, thus indicating a potential

for a substantial heating ar cooling load. Three criteria were used in this review:

1. Centralized operation
2. University or hospital (since manufacturers with more than 100 employees were already included).
3. More than 400 employees.

Atlanta Medical Facilities were used to identify hospitals in the Atlanta area with over 350 beds. This criterion was selected on the basis of an assessment of the typical "hotel and services" load (i.e., their requirements for continuous heating, cooling, and hot water) of similar institutions. Although individual steam consumption varies as a function of such variables as equipment used and laundry facilities, an institution with fewer than 350 beds will not usually require more than 25,000 lb/hr (the screening limit in the market study) in any case.

Once this initial screening effort was completed, control sheets and a standard questionnaire were developed to facilitate the phone contact portion of the feasibility effort.

TELEPHONE SURVEY

Over 140 candidates identified in the review of data sources were contacted by telephone during a 4-week period. After 2 weeks, 20 organizations identified as having only marginal potential (i.e, demand less than 25,000 lb/hr steam equivalent) were eliminated from the survey to focus efforts on the more likely candidates.

Contacts were very helpful. However, a minority of organizations contacted refused to answer the questions over the phone. The following companies have not yet responded to letters of inquiry: Coats & Clark, General Motors, North Chemical Company, Owens Corning, and Martin Marietta.

PLANT VISITS

Based on the results of the telephone survey, a number of companies and institutions were identified as having sufficient potential to warrant a fact-finding site visit. These are: The Young Refining Corporation;

Emory University, a three-hospital complex in Fulton County; the Kennestone Hospital in Cobb County; Lockheed-Georgia Company, and the Atlanta International Airport. Three other potential energy users were also surveyed during the evaluation: the Downtown Atlanta District Steam Loop and the electrical generation department, both divisions of Georgia Power Company (GP); and the R.M. Clayton Sewage Treatment Plant, run by the Atlanta Public Works Department. Each potential market was evaluated against several general criteria:

- Technical capability to use recovered energy
- Continuity of operations
- Current use of high-cost fuel
- Availability of or proximity to a suitable site
- Proximity to the centroid of the wasteshed
- Stability as a long-term energy buyer
- Interest in participating in a resource recovery project.

A description of the most viable candidates identified during this visit is summarized in Chapter 2. Appendix B contains those markets which have only limited potential but which may require further evaluation. Appendix C is a summary listing of energy users with low potential, and Appendix D is a summary listing of users, with no potential.

ATTACHMENT 1
NATIONAL EMISSION DATA SYSTEMS (NEDS)

Copies of the National Emission Data Systems (NEDS) User Point File for the Atlanta Region and of NEDS particulate and SO_2 Selected Data Report for Georgia were obtained by courtesy of Region IV EPA. Exhibits A.1 and A.2 are sample pages from these reports.

The NEDS survey is a valuable supplemental source of important data in performing an energy market survey. A company is listed on NEDS if it releases more than 100 pounds per year of one of five pollutants after the installation of air pollution control equipment. It is useful in substantiating a company's energy consumption and in identifying generic industries with resource recovery potential. It should not, however, be used as the sole data source in identifying potential markets because high energy use does not correspond precisely with NEDS listings. For example, a natural gas-fired boiler with air pollution control could produce well in excess of 25,000 lb/hr of steam and still not be listed on NEDS.

These reports were helpful in identifying potential markets because they identify area industries, boiler capacity in millions of British Thermal Units (mBtu), and energy-inentsive industries by SIC Code. Boiler design capacity in mBtu can be used to identify specific companies that use large amounts of steam. NEDS sources also can be used to identify types of industries that are high consumers of energy by SIC number.

EXHIBIT A.1

NEDS USER POINT FILE

SELECTION DATA REPORT

DATE: 6/24/81

STATE	COUNTY	PLANT	YEAR	NAME - ADDRESS	PERSONAL CONTACT	OWNERSHIP	SIC	BOILER CAPACITY (100 lbs STEAM)
11	1120	0002	79	MACDOUGALD-WARREN	PLANT MGR	P	2951	0
11	1120	0008	79	SHERWIN WILLIAMS CO	PRESNELL D	P	2851	0
11	1120	0008	79	SHERWIN WILLIAMS CO	PRESNELL D	P	2851	0
11	1120	0008	79	SHERWIN WILLIAMS CO	PRESNELL D	P	2851	10
11	1120	0008	79	SHERWIN WILLIAMS CO	PRESNELL D	P	2851	2(
11	1120	0009	79	AMERICAN CAN CO LA	MCCUSKER H	P	3411	0
11	1120	0016	79	CLAYTON ASPHALT 15	PLANT MGR	P	2951	0
11	1120	0020	79	AMERICAN CAN CO LA	BURNHAM A	P	3411	0
11	1120	0036	79	KOPPERS CO 1579 KOPP	COGAN K	P	2819	0
11	1120	0036	79	KOPPERS CO 1579 KOPP	COGAN K	P	2819	0
11	1120	0036	79	KOPPERS CO 1579 KOPP	COGAN K	P	2819	0
11	1120	0036	79	KOPPERS CO 1579 KOPP	COGAN K	P	2819	0
11	1120	0043	79	C W MATTHEWS #17	AGE S	P	2951	0
11	1120	0043	79	C W MATTHEWS #17	AGE S	P	2951	0
11	1120	0047	79	HATCHER PAVING 4120M	MORRIS E	P	2951	0
11	1120	0047	79	HATCHER PAVING 4120M	MORRIS E	P	2951	0
11	1120	0047	79	HATCHER PAVING 4120M	MORRIS E	P	2951	0
11	1120	0061	79	JONESBORO TOOL & DIE	COOPER C	P	3362	0
11	1160	0003	79	GA POWER CO-MCDONOUG	BYERLEY T E	U	4911	2,339
11	1160	0003	79	GA POWER CO-MCDONOUG	BYERLEY T E	U	4911	2,339
11	1160	0003	79	GA POWER CO-MCDONOUG	BYERLEY T E	U	4911	2,339
11	1160	0003	79	GA POWER CO-MCDONOUG	BYERLEY T E	U	4911	2,339
11	1160	0003	79	GA POWER CO-MCDONOUG	BYERLEY T E	U	4911	2,339
11	1160	0003	79	GA POWER CO-MCDONOUG	BYERLEY T E	U	4911	2,339
11	1160	0004	79	GA POWER CO-ATKINSON	BYERLEY T E	U	4911	443
11	1160	0004	79	GA POWER CO-ATKINSON	BYERLEY T E	U	4911	443
11	1160	0004	79	GA POWER CO-ATKINSON	BYERLEY T E	U	4911	443
11	1160	0004	79	GA POWER CO-ATKINSON	BYERLEY T E	U	4911	443
11	1160	0004	79	GA POWER CO-ATKINSON	BYERLEY T E	U	4911	850
11	1160	0004	79	GA POWER CO-ATKINSON	BYERLEY T E	U	4911	850
11	1160	0004	79	GA POWER CO-ATKINSON	BYERLEY T E	U	4911	770
11	1160	0004	79	GA POWER CO-ATKINSON	BYERLEY T E	U	4911	770
11	1160	0004	79	GA POWER CO-ATKINSON	BYERLEY T E	U	4911	770
11	1160	0008	79	C W MATTHEWS #13	AGE S	P	2951	102

EXHIBIT A.2

EPA REGION IV NEDS PARTICULATE AND SO_2 SELECTED DATA REPORT

ST	CNTY	AGCR	PLANT	NAME AND ADDRESS	POINT	SCC	COMMENTS	EMISSIONS IN TONS/YEAR ESTIMATED PART	ESTIMATED SO2	ALLOWABLE PART	ALLOWABLE SO2	COMP STAT	CONTROL EQUIP-PRI	CONTROL EQUIP-SEC	PART % EFF	BOILER CAP	PROCESS RATE	% SULFUR	% ASH	BTU	YR CD
11	0120	049	0002	BLOUNT + QUARK INC US341 3 MI W BAILEY																	
					01	30500201		2	2	40	69	1	008	017	95,0		95000				74
						39000501						1					200	,13			74
11	0180	049	0006	PEARSON WOOD PROD PO DRAWER 799 PEARSON																	
					01	10200902	BOILER WOOD FIRED	52	19	60	504		008	008	90,0	83	24800		2,5	9	76
11	0300	054	0006	GENERAL REFRACTORIES CO-STEVENS POTTERY																	
					01	30500801	CALCINING KILN	24	41	55	51	1	016	000	99,2		39600				75
						39000504	STANDBY FUEL- OIL					1					273	2,		146	75
						39000699	PRIMARY FUEL- GAS					1					211			1030	75
11	0300	054	0029	J.P.STEVENS & CO,MACON HWY,MILLEDGEVILLE																	
					01	10200402	BOILER#1 STANDBY OIL			43	150	1	000	000	00,0	53		1,50		149	76
						10200602	BOILER#1 STANDBY GAS					1								1030	76
					02	10200402	BOILER#2 STANDBY OIL			43	150	1	000	000	00,0	53		1,50		149	76
						10200602	BOILER#2 STANDBY GAS					1								1030	76
					03	10200402	BOILER#3 ON #5 OIL	2	15	43	150	1	000	000	00,0	88	130	1,50		149	76
						10200602	BOILER#3 ON NAT.GAS					1					146			1030	76
11	0360	057	0005	JOHNS-MANVILLE CORP P O BOX 763																	
					11	30501204		69		138		1	000	000	00,0		4288				75
					12	30501204		87		174		1	000	000	00,0		5034				75
					13	30501204		87		173		1	000	000	00,0		5034				75
					14	30501204		69		138		1	000	000	00,0		4288				75
					21	30501205		3		12		1	000	000	00,0		4213				75
						39000699	CURING OVEN					1					7				75
					22	30501205		4		14		1	000	000	00,0		4947				75
						39000699	CURING OVEN					1					7				75
					23	30501205		8		14	6	1	000	000	00,0		4947				75
						39000699	CURING OVEN					1					12				75
					24	30501205		6		12		1	000	000	00,0		4219				75
						39000699	CURING OVEN					1					12				75
11	0360	057	0013	JOHNSON PAVING CO-AUBURN																	
					01	30500201	ROTARY DRYER	5	3	7	18	1	008	000	99,0		87000				75
11	0380	055	0001	SHEPHARD CONST 5MI N US 41 KINGSTON3045																	
					01	10200501	BURNER FOR DRYER	13	1	13	125	1	001	000	99,0	166	650	,1		140	76
						30500201	ASPHALT PAVING MIX					1					500000				76
11	0380	055	0007	NEW RIVERSIDE OCHRE-CARTERSVILLE																	
					01	30504033	JIM ORE DRYER	3	1	28	50	1	017	000	99,0		24500				75
						39000599	STANDBY #2 FUEL OIL					1					50	,12		140	75
					02	30504033	FLOAT ORE DRYER	200	1	19	95	4	000	000	00,0		9500				75

ATTACHMENT 2

CRITERIA USED TO SELECT COMPANIES FROM ATLANTA MANUFACTURING

Atlanta Manufacturing contains company demographics on all manufacturing concerns located in the 15-county Atlanta Standard Metropolitan Statistical Area (SMSA). This information was extracted from the 1978-1979 Georgia Manufacturing Directory prepared by the Georgia Department of Industry and Trade.

Selection of potential markets from this document was based on three criteria: number of employees, an SIC number indicating an energy-intensive process, and proximity to the Atlanta wasteshed (25 miles from the center of Atlanta). Companies meeting these selection criteria were included in the telephone survey list.

APPENDIX B
ENERGY USERS WITH LIMITED MARKET POTENTIAL

Several potential markets were identified during the market survey that appeared to be viable candidates for resource recovery projects but were later eliminated from this survey because of various limitations in market potential. These energy users are discussed very briefly below.

Georgia Power Company

Selling electricity as a primary product of resource recovery to Georgia Power (GP) is uneconomical because of the utility's relatively low fuel costs. (See Chapter 2). GP power plants are not feasible purchasers for refuse-generated steam due to the high pressures required.

Sales of refuse-derived fuel (RDF) to a GP power plant just west of the Chattahoochee River was discussed with utility officials. This technique is being used successfully in Ames, Iowa, and Madison, Wisconsin, but in other installations serious technical problems have been encountered. For example, in Milwaukee, the chemical reaction between RDF and high-sulfur coal increased slagging problems in the utility boiler.

All of the GP's coal plants fire pulverized coal that has been ground to a powdery consistency. As a result, plant furnaces do not have grates that can hold pieces of fuel that take more than 2 or 3 seconds to burn. To cofire RDF in any GP unit, the utility would have to invest several million dollars to install grates even before a test burning program could commence. Although an RDF system may be technically feasible, utilities would be understandably reluctant to incur such costs or to risk damaging their boilers.

Due to the relatively poor economics and the fact that GP is unwilling to participate in an RDF program (having studied the idea several times in the past), the GP plant was eliminated as a potential market for RDF.

Young Refining Corporation

The Young Refining Corporation is a privately held company that operates an asphalt and specialty roofing products refinery in Douglasville, about 20 miles west of Atlanta in Cobb County. The company currently produces about 12,000 lb/hr of steam on a continuous basis in its boilers. Natural gas is the primary fuel; oil is used as a backup fuel, and black liquor, a byproduct of the pulp industry, is used when available. This energy load is the rough equivalent of the energy that could be produced from 60 TPD_7 of solid waste. Because the black liquor would yield very little energy credit if replaced, and the company's boilers might have to remain on-line to provide load following, Young Refining represents a disposal solution for only slightly more than 1 percent of the region's solid wastes. However, because it meets the other requirements for a waste-to-energy plant and its management is potentially interested in developing a system, Young Refining should not be ruled out for the development of a private system.

Downtown Atlanta Piped Water System

The U.S. Department of Housing and Urban Development (HUD) and the Department of Energy (DOE) recently awarded a grant to the City of Atlanta to study the feasibility of installing hot and chilled water heating and cooling systems in downtown Atlanta buildings. The grant was awarded on the basis of engineering studies that showed such a system to be more thermally efficient than a steam loop or individual heating and cooling systems. One of the energy sources to be included in the study is municipal solid waste.

The success of such a system will depend largely on the guarantee before construction that sufficient customers will purchase energy from the system, 20 years or longer. Such commitments will be difficult to secure. Even with committed markets, the investment for installing piping, which involves the excavation and repair of many city streets, will be very large and quite difficult to finance. For example, Georgia Power, who has the Atlanta franchise for district heating, would find such a project very difficult to finance, especially since the debt on its present district heating loop is still outstanding.

Because the study has not been completed and because the implementation of such a system will be difficult, it was concluded that this project should not be included in the list of markets having the most potential for resource recovery at this time. ARC should reevaluate the project after the completion of the HUD-DOE study.

Emory University

Emory University is a multidisciplinary private institution; over 5,000 students are enrolled in its graduate and undergraduate schools. Emory's 640-acre site is located just east of Atlanta in Druid Hills, DeKalb County. The site contains the undergraduate college, medical school, dental school, hospital, primate research center, and many dormitories and other support buildings.

Emory produces steam in a central power plant for heating and several other uses. Two 100,000 lb/hr boilers and two older 25,000-lb/hr boilers produce saturated steam at 125 psig. Average demand varies from 50,000-lb/hr in the summer to over 125,000 lb/hr in the winter. Its electrical demand, averaging about 5,000 kW, is supplied by Georgia Power.

The size of the baseload steam demand and Emory's use of natural gas, which is being deregulated, suggests that a 250-TPD$_7$ resource recovery plant would be technically and economically feasible. However, two major factors reduce Emory's potential as a market: the University is located in a residential area, making plant siting difficult; and lack of interest among officials contacted. The converstion or replacement of the existing pyrolytic incinerator with a heat recovery unit that could produce steam from on-campus wastes may be a more promising plan than a full-scale resource recovery project.

Three-Hospital Complex

Northside, Scottish Rite, and Saint Joseph's hospitals are located within a one-quarter-mile radius of one another in the north section of Fulton County at the intersection of Highways 400 and I-285. They were

selected as a potential resource recovery market because their combined energy load is continuous throughout the year and because of their proximity. Combined hospital populations include over 650 inpatients and over 1,000 employees.

Each hospital provides its hot water, heating and cooling (two hospitals), and laundry (one hospital) requirements with steam from its boilers. Electric power is purchased from GP; each hospital can produce emergency power. The combined steam loads are sufficient to purchase most of the energy from a 50-TPD_7 waste-to-energy system during the entire year, and from a 100-TPD_7 system during the winter months. The recovery of all potential energy revenue from a 100-TPD_7 facility would require the additional installation of electrical generation equipment. Such equipment would represent an expensive capital investment in this size range, and in Georgia the electricity produced would yield a relatively low revenue. Other major barriers to resource recovery are the lack of a suitable system site and traffic congestion, which would interfere with waste delivery.

Kennestone Hospital

Kennestone Hospital is a 469-bed general hospital located in Marietta, Cobb County. Its heating, cooling, sterilizing, and laundry needs are met with several boilers operating at various locations throughout the hospital complex. Steam consumption at Kennestone would match the output of a 40- to 50-TPD_7 refuse-to-energy facility for most of the year. This size is probably too small for a public resource recovery project. In addition, there are few sites available for a system and waste hauling through the surrounding residential area would be difficult.

City of Atlanta Industrial Development

The City of Atlanta is trying to attract manufacturers to the many vacant industrial areas in the central city. In addition to land, Atlanta has a large supply of available labor for industrial developers. To make the sites even more attractive, the city could make firm commitments of reasonably priced energy to interested manufacturers. This

energy could be produced from the city's own solid waste as a base-load fuel. Industrial developments in the planning stages are an ideal market for waste-derived energy. Such systems provide both fuel value and capacity credit, or investment value (i.e, by eliminating the need for building individual energy systems).

This option cannot be viewed as a viable opportunity until a new industry expresses serious interest. Nevertheless, this concept has been identified in this report because of its synergistic effects on three Atlanta objectives--attraction of new manufacturing industry, solution of solid waste disposal problems, and conservation of scarce energy resources.

APPENDIX C

ATLANTA-AREA ENERGY USERS INTERVIEWED WITH LIMITED MARKET POTENTIAL

The energy users listed in Exhibit C-1 are considered to have a limited potential as waste-to-energy markets because of their marginal steam loads (15,000 to 25,000 lb/hr), large fluctuations in load, or other technical or institutional constraints. Information on energy use is given for each candidate, with comments relating to the potential for resource recovery.

ENERGY USERS WITH LIMITED POTENTIAL

NAME	SIC CODE	COUNTY	CITY	ENERGY USE: ENERGY FORM	ENERGY USE: MAXIMUM WINTER RATE	ENERGY USE: MINIMUM SUMMER RATE	USE/DURATION: HRS/DAY	USE/DURATION: DAYS/WEEK	CONSTRAINTS
Amarlite-Anaconda Aluminum Company	3442	Fulton	Atlanta	Steam	42 klb/hr	20 klb/hr	24	5	Boilers shut down completely during weekends in the summer.
Allied Foods, Inc.	2047	Fulton	Atlanta	Steam	14 klb/hr	14 klb/hr	12	5	Boilers shut down completely at night.
Austell Box Board Corporation	2649	Cobb	Austell	Steam	180 klb/hr	180 klb/hr	24	7	Company recently invested early this year in a coal-fired facility with enought capacity to handle steam requirements for the next 20-30 years. No apparent interest in new energy proposals.
AZS Chemical	2821 2843	Fulton	Atlanta	Steam	15 klb/hr	12 klb/hr	24	5-7	Additional use of natural gas in two furnaces (5 MMBtu/hr total) to heat a "heat-exchange oil" to 550°F. Chemical manufacture of AZS is a batch process.
Ford Motor Company	3711	Fulton	Hapeville	Steam	40 klb/hr	20 klb/hr	8	5	During evening and graveyard shifts, boilers fire at reduced rates (10 klb/hr). Boilers shut down completely during weekends.
Fort McPherson	-	Fulton	-	Steam	5 klb/hr	4 klb/hr	12-24	5-7	Chief steam use for base hospital and laundry. Small isolated boilers supply steam requirements for other outlying buildings. Air-conditioning service is supplied by electric-powered window and central units. The air-conditioning electric load does not appear to be large enought to warrant further investigation into the possibility of conversion to steam absorption chillers.
Georgia Institute of Technology	-	Fulton	Atlanta	Steam	120 klb/hr	120 klb/hr	24	7	The average annual steam production rate for the last 2 years was about 21 klb/hr @ 8760 hrs/yr. Due to location in a relatively densely populated area, land availability is a serious potential problem.
Georgia State University	-	Fulton	Atlanta	Steam	25 klb/hr	25 klb/hr	24	7	Steam requirements supplied by the city's steam loop to each building. Repiping to accomodate a centralized steam supply appears financially impractical.
Keebler Company	2052	Fulton	Atlanta	Hot Gas	-	-	-	-	Ovens fired directly with natural gas burners - the products of combustion pass directly over the food. Stringent purity requirements appear to limit Keebler as a potential energy market. Energy consumption information unavailable.

NOTE: All companies and institutions use natural gas as their primary fuel except Austell Box Board Corporation, which uses coal, and Trumbull Asphalt, which uses both natural gas and waste oil.

EXHIBIT C-1 (continued)

NAME	SIC CODE	COUNTY	CITY	ENERGY USE: ENERGY FORM	MAXIMUM WINTER RATE	MINIMUM SUMMER RATE	USE/DURATION: HRS/DAY	DAYS/WEEK	CONSTRAINTS
Mead Packaging Division	2649	Fulton	Atlanta	Steam	28 klb/hr	10 klb/hr	24	5	-
Mead Container Division	2653 2631	Fulton	Atlanta	Steam	15 klb/hr	15 klb/hr	16	5	-
Owens-Illinois-Forest Products Division	2653	Fulton	Atlanta	Steam	11 klb/hr	11 klb/hr	24	5	Boilers are shut down completly during weekend.
Owens-Illinois-Glass Container Division	3221	Fulton	Atlanta	Hot Gases	5 MMCF/day (natural gas)	5 MMCF/day (natural gas)	24	5	Hot gas used to melt and anneal glass. The batch nature of the process, extreme purity requirements for the hot combustion gases, and high temperature requirement (2700°F) limits potential as an energy market.
Sherman Williams	2841	Clayton	Morrow	Steam	17.25 klb/hr	8.7 klb/hr	-	-	Steam used for space heating only
Sonoco	2650	Fulton	Atlanta	Steam	40 klb/hr	20 klb/hr	24	6	Steam used to dry paperboard-function of production demand.
Trumbull Asphalt	2911	Fulton	Atlanta	Steam	6 klb/hr	6 klb/hr	24	5	Boilers represent about 35-40% of energy consumption. The balance of the energy goes to heat various tanks and vessels which are individually fired. Trumbull has recently considered recovering waste heat from its' stacks but couldn't justify the required investment.
Western Electric	3357	Guinnet	Norcross	Steam	25 klb/hr	6 klb/hr	24	5	-
Weyerhauser	2653	Dekalb	Lithonia	Steam	17 klb/hr	-	24	5	17 klb/hr capacity - 5 days a week operation.
Zep Manufacturing	2842	Fulton	Atlanta	Steam	28 klb/hr	14 klb/hr	16	5	Neighbor of Allied Foods

NOTE: All companies and institutions use natural gas as their primary fuel except Austell Box Board Corporation, which uses coal, and Trumbull Asphalt, which uses both natural gas and waste oil.

APPENDIX D
ENERGY USERS WITh NO MARKET POTENTIAL

The energy users listed in Exhibit D.1 contacted during the preliminary survey have little or no energy market potential.

INDUSTRIAL FIRMS	SIC CODE	COUNTY*	CITY
Alcan Cable Division-Alcan Aluminum Corp.	3357	D	Tucker
American Associated Companies	2392,2283	F	Atlanta
American Can	3411	C	Forest Park
Arrow Co. Division-Cluette Peabody & Co.	2321	F	Atlanta
Atlanta Brick & Tile	3251	F	Atlanta
Atlanta Coca Cola Bottling Co.	2086	F	Atlanta
Atlanta Dairies	2026	F	Atlanta
Atlanta Stove Works	3469	F	Atlanta
Atlantic Steel	3313	F	Atlanta
Bankhead Enterprises	3715	F	Atlanta
Biolab, Inc.	2842	D	Decatur
J.H. Block & Company	2339	F	Atlanta
Bressler Bros.	2337	F	Atlanta
L.S. Brown	2394	F	Atlanta
Chattahoochee Brick Co.	3251	F	Atlanta
Container Corp. of America	3079	D	Lithonia
Continental Can Group	3411	C	Forest Park
Continental Forest Industries	2655	D	Lithonia
Davidson Mineral Properties	3281	D	Lithonia
Dart Container	3079	D	Lithonia
Dupont Finishing Division	2851	D	Tucker
Edwards Pie Co.	2051	D	Atlanta
Foote and Davies	2752	D	Doraville
Frito Lay, Inc.	2099	D	Chamblee
Gaylord Container Division	2653	D	Doraville
George Hormel & Co.	2011	D	Tucker
Glifford Hill & Co.	3272	C	Forest Park
Glass Containers Corp.	3221	C	Forest Park
Greif Brothers Corp.	2655	D	Tucker
Guardian Chemical Co.	2841	F	Atlanta

* C= Clayton; D= Dekalb; F= Fulton; G= Gwinnett

INDUSTRIAL FIRMS	SIC CODE	COUNTY*	CITY
Harland, John H. Co.	2751	D	Atlanta
Hatcher Paving	2951	C	-
Howard Concrete Pipe Co.	3272	Cb	Marietta
International Bakerage, Inc.	2048	C	Forest Park
Jenos	2038	D	Atlanta
Kem Manufacturing Corp.	2842	D	Tucker
Kemos Inc. - Division of Rohm & Haas	2272	C	Marietta
Kraft, Inc.	2022	D	Atlanta
Lithonia Lighting	3645	R	Conyers
Mars Chemical Corp.	2819	F	Atlanta
MacDouglad-Warren Co.	2951	Cb	Smyrna
R.L. Mathis Certified Dariy	2026	D	Clarkston
Mayo Chemical Co.	2819	Cb	Smyrna
Merico, Inc.	2051	C	Forest Park
Munch, Corp.	2099	C	Forest Park
Nabisco, Inc.	2052	F	Atlanta
N.L. Industries, Inc.	3356	F	Atlanta
Pepsi Cola Bottling	2086	F	Atlanta
P.P. G. Industries	2851	F	Eastpoint
Puritan Chemical	2842	F	Atlanta
Sanders Paints	2851	D	Tucker
Servomation	2099	C	Clarkston
Scientific Atlanta	3825	D	Atlanta
Scottdale Mills	2211	D	Scottdale
Scripto, Inc.	3951	G	Norcross
Sentry Cehmical Co.	2842	D	Scottdale
Shepherd Construction Co.	2951	F	Atlanta
Simmons Co.	2515	F	Atlanta
Southern Tea Co.	2099	F	Atlanta
St. Joe Paper Co.	2653	F	College Park
St. Regis Paper Co. - Flex Pkg. Division	2641	F	Atlanta
Tip Top Poultry	2016	Cb	Marietta

* Cb= Cobb; R= Rockdale

INDUSTRIAL FIRMS	SIC CODE	COUNTY*	CITY
Union Camp	2653	Cb	Forest Park
Whitehead Die Castings	3552	D	Atlanta
W.P. Stephens Lumber Co.	2431	Cb	Marietta

HOSPITALS	COUNTY	CITY
Atlanta West Hospital	Douglas	Atlanta
Crawford Long	Fulton	Atlanta
Dekalb General	Dekalb	Decatur
Georgia Baptist	Fulton	Atlanta
Piedmont Hospital	Fulton	Atlanta

* Cb= Cobb; R= Rockdale